Fabrication and simulation of individual site defects in opals

F. Jonsson[1], C.M. Sotomayor Torres[1], and J. Seekamp[2],
[1]Tyndall National Institute, University College Cork, Lee Maltings, Cork, Ireland
[2]International University of Bremen, D-28758 Bremen, Germany

One major challenge in controlling spontaneous emission in self-assembled photonic crystals is the artificial introduction of defects and cavities. We report on electron beam lithography for the fabrication of individual site defects and lattices in self-assembled three-dimensional photonic crystals, fabricated of poly(methyl methacrylate) beads of 500 nm diameter. In the optimization of electron beam parameters for fabrication of defects we employed a fully three-dimensional Monte Carlo simulation of the electron scattering. Simulation results obtained so far correspond very well with our experimental results of fabrication [1]. In particular, this work opens the road for inverted opals with light emitting centra placed in targeted individual site cavities.

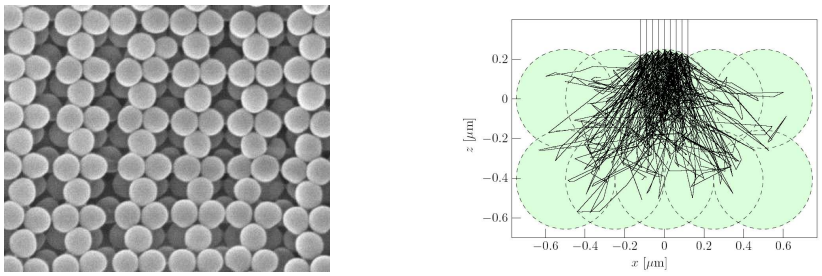

Figure 1. Lattice of defects inscribed in self-assembled PMMA opal (left), and simulated electron scattering from 9×9 grid of injection sites at E_{acc}=5.0 kV (right).

[1] F. Jonsson et al., *Microelectron. Eng.* (2005, article in press).